PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Machines for Making Hollow Bodies by Spinning Metallic Sheet Material

We, KARL KOEHLE, Senior, and HERMANN HUMMEL, both German Nationals, trading as the firm Bohner & Koehle, of 4—10, Weilstrasse, Esslingen/Neckar, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to a machine for making a hollow body by spinning a piece of metallic sheet material by means of a rotatable forming tool over and against which the material is pressed, to form the hollow body, by means of a pressure-applying tool travelling alongside the forming surface of the rotatable forming tool.

In known machines of this kind, the end face of the forming tool comprises a bearing surface for the piece of sheet material which is pressed against the bearing surface by means of a footstock spindle. With these known tools it is only possible to produce hollow bodies which have a flat central section, because the pressure-applying tool cannot have access to the area of the material which is held by the foot stock, and because the bearing surface on the forming tool must not be less than a certain area owing to the torque that has to be transmitted to the workpiece.

The present invention aims to provide a machine by which it is possible to produce from sheet material hollow bodies having conical or curved ends.

According to this invention a machine for making hollow bodies by spinning metallic sheet material by means of a rotatable forming tool over and against which the material is pressed, to form a hollow body, by means of a pressure-applying tool travelling alongside the forming surface of the forming tool, is distinguished in that a supporting device on which the sheet material to be formed is placed, is adapted to hold the material on its outer edge, the parts of the device for clamping the material being equidistantly spaced from the axis of the forming tool and rotatable at the same speed and in the same direction as the forming tool, as well as being displaceable at the same rate relatively to one another in a direction parallel to the axis of the forming tool.

In a simple and inexpensive embodiment, the supporting device comprises a workpiece supporting ring which carries workpiece clamping parts and which is connected with the forming tool through guide rods slidably mounted in bushes.

When dealing with relatively long workpieces, it is necessary for the guide rods to be axially displaced through a considerable distance. This is usually not possible in the case of guide rods which are fixed to the forming tool. To provide for this greater length of travel of the guide rods, the supporting device can be constructed with a supporting ring which carries the workpiece clamping parts and which is driven by a gearing at the same speed of rotation as the forming tool and which is so mounted that it can rotate relative to the guide rods which are displaceably mounted in a fixed part of the machine,

The invention is further described with reference to the accompanying drawings which illustrate two embodiments by way of example and in which: —

Fig. 1 is a longitudinal section of the first embodiment, certain parts at the right of the centre line being shown displaced, from their positions shown at the left of the centre line, by the operation of one of the forming tools;

Fig. 2 is a plan view of Fig. 1 before operation by the forming tool; and

Fig. 3 is a longtiudinal section in more or less diagrammatic form of the second embodiment.

[*Price 4s. 6d.*]

Referring to the drawings a spindle stock 1 is placed on a bench, which is not shown in the drawings. The bench and the spindle stock carry drive assemblies, which are also not shown in the drawings, for driving a spindle 3 which extends from the spindle stock 1. A flange 5 into which an annular element 7 is screwed is mounted on the spindle 3. Four guide bushes 8, of which two are shown in Fig. 1, extend vertically from the periphery of the annular element 7. Each bush slidably receives a guide rod 10 and end portions of the guide rods which extend beyond the bushes 8 are accommodated in a supporting ring 12. Each rod 10 has its end portion received in a bore 14 in the supporting ring 12 and is provided with an end flange 16 which bears against the end face of the supporting ring 12 remote from the bush 8. Each rod 10 is secured to the supporting ring 12 by screws 18 located in the flange 16 and screwed in the ring 12. The side of the flange 16 facing the centre is flat.

Workpiece clamping members in the form of straps 23 are fixed to the supporting ring 12 by means of screws 20 and 21. These straps are detachable so that a workpiece consisting of a sheet of material 25 can be placed beneath them and thereby clamped to the supporting ring 12. The sheet material 25 can extend as far as the flat portions of the end flanges 16 of the rods 10. When the ring 12 is rotated, the rotary motion is mainly transmitted to the sheet material 25 by reason of the straps 23 engaging portions of the outer perimeter of the sheet material. If the sheet material is in contact with the end flanges 16, then the latter can also serve to transmit the rotary motion to the sheet material.

A forming tool 29, substantially comprising a conically formed element, is fixed to the annular driving element 7 by means of screws 27. A retaining bolt 31 passes through the centre of the forming tool 29. The end of the bolt terminates near the tip of the forming tool and is internally screwthreaded to receive a correspondingly threaded end of an element 33 which forms the tip of the forming tool. The element 33 may be of any desired shape. It may, as shown in the drawings, be pointed at the end to constitute a continuation of the tool 29, or alternatively, it may have a curved zone, for example a spherical zone.

A pressure-applying tool 35 in the form of a pressure roller is mounted at one side of the tool 29 and is guided in a cruciform support (not shown in the drawings) in such a manner that it may be moved at a certain distance alongside and parallel to the surface line of the forming tool 29 (when the latter is viewed at rest). The cruciform support may be driven mechanically or by hydraulic means.

To produce a formed article as shown in part at the right of the centre line of Fig. 1, the sheet material 25 is clamped between the straps 23 and supporting ring 12. During the rotation of the spindle 3, which drives the forming tool 29 together with the supporting ring 12 and associated parts, the pressure tool 35 is placed in the centre of the sheet material 25, the cruciform support having previously been brought into the desired position for guiding the pressure tool. The pressure tool 35 is guided alongside the rotating forming tool 29, thereby converting the sheet material 25 into a hollow body. During the process of shaping the hollow body, the supporting ring 12 moves in the axial direction of the forming tool 29. This axial movement is terminated when the supporting ring 12 abouts against the bushes 8 so that the rods 10 do not come into contact with the spindle stock 1. When the hollow body 25 has been formed, the pressure roller 35 is removed and returned to its out-of-use position at a certain distance from the tip of the forming tool 29. The finished hollow body is then removed from the supporting ring 12 by releasing the straps 23.

In the second embodiment shown in Fig. 3, guide rods 42 are arranged in a circle around a forming tool 44 and are mounted in bearings 48, shown in dotted lines, located in the housing 46 of the spindle stock. The forming tool 44 is screwed in known manner onto a spindle 50 extending from the spindle stock 46. An annular element 52 connects the upper ends of the rod 42 which pass through the annular element to project beyond the end face thereof remote from the spindle stock 46. The projecting ends of the rods 42 carry rollers 54 which are secured in any convenient manner against axial displacement on the rods. The rollers 54 combine to form a bearing for a workpiece supporting ring 56 which has an annular groove 57 in its peripheral edge to provide a track in which the rollers engage. A sheet of material 58 is clamped to the supporting ring 56 by means of straps, or the like. The end of the supporting ring 56 facing the spindle stock 46 is formed with a ring gear 60 which meshes with a pinion 62, the shaft 64 of which passes through the annular element 52. The shaft 64 is mounted in a bearing 66 in the spindle stock 46 and is driven, through the interposition of gear wheels 68 and 70, at such a speed that the ring gear 60 rotates at the same speed as spindle 50. The end of shaft 64 near the gear wheel 70 is constructed as a splined shaft so that the shaft 64 can slide through the gear wheel 70 in the axial direction thereof.

To form a hollow body from the sheet of material 58, the work-supporting device is moved in the axial direction of the rotating forming tool 44, and the hollow body is

formed by a pressure tool as described in connection with the first embodiment, the guide rods 42 moving axially in their bearings 48 and the shaft 64 moving axially in its bearing 66. The bearing 66 may be protected by means of a bush which slidably receives the shaft 64 and which itself is slidable within the bearing 66.

Instead of being mounted in the rollers 54, the workpiece-supporting ring 56 may be journalled in one or more roller bearings, the inner and outer diameters of which corresponds approximately to the outer diameter of the ring 56 and the inner diameter of the annular element 52, respectively.

WHAT WE CLAIM IS:—

1. A machine for making hollow bodies by spinning metallic sheet material by means of a rotatable forming tool over and against which the material is pressed, to form a hollow body, by means of a pressure-applying tool travelling alongside the forming surface of the rotatable forming tool, in which a supporting device, on which the sheet material to be formed is placed, is adapted to hold the material on its outer edge, the parts of the device for clamping the sheet material being equidistantly spaced from the axis of the forming tool and rotatable at the same speed and in the same direction as the forming tool, as well as being displaceable at the same rate relatively to one another in a direction parallel to the axis of the forming tool.

2. A machine as claimed in Claim 1, in which the clamping parts are equidistantly spaced from one another to overlie corresponding portions of the perimeter of the sheet material.

3. A machine as claimed in Claim 1 or 2, in which the supporting device comprises a supporting ring carrying the clamping parts, which ring is connected to the forming tool through guide rods slidably mounted in bearing bushes.

4. A machine as claimed in Claim 3, in which the bushes are fixed to the forming tool at its end near the spindle which drives it.

5. A machine as claimed in Claim 3 or 4, in which each guide rod is inserted through the supporting ring and has a flanged portion secured to the supporting ring by securing means, and in which the flanged portion has a flat surface facing the centre of the ring for engaging the edge of the sheet material.

6. A machine as claimed in Claim 1, in which the supporting device has a supporting element which carries the workpiece clamping parts and which is driven by a gearing at the same speed of rotation as the forming tool and which is mounted to be rotatable relative to guide rods which are mounted to be axially displaceable in a fixed portion of the machine.

7. A machine according to Claim 6, in which the end of each guide rod remote from the fixed portion of the machine extends through a fixed annular element and carries at its end projecting beyond the annular element a roller for journalling the supporting ring.

8. A machine according to Claim 6, in which the end of each guide rod remote from the fixed portion of the machine carries a fixed annular element on which the supporting ring is mounted.

9. A machine for making hollow bodies from metallic sheet material, constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in Figs. 1 and 2 of the accompanying drawings.

10. A machine for making hollow bodies from metallic sheet material, constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in Fig. 3 of the accompanying drawings.

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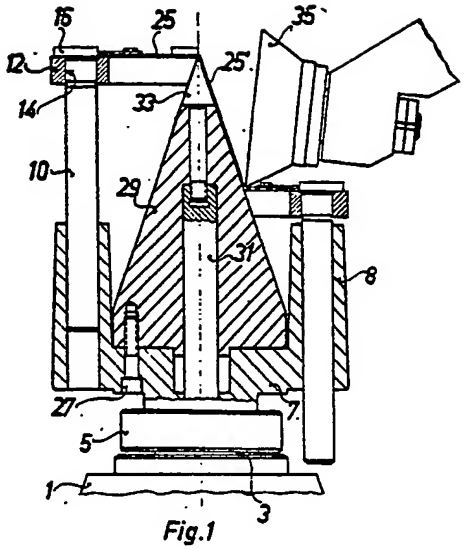


Fig.1

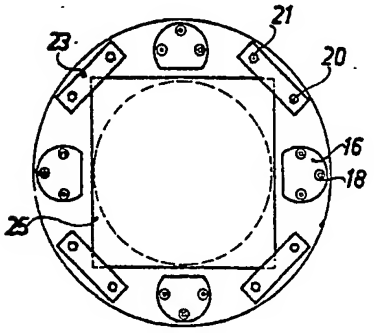
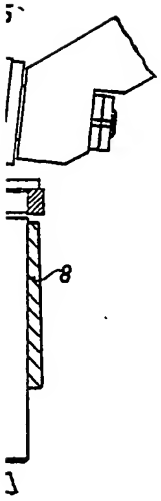


Fig.2

919927 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2



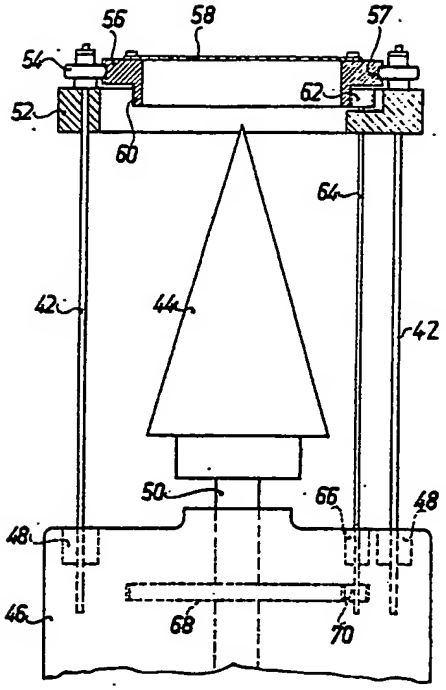


Fig. 3

919927 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

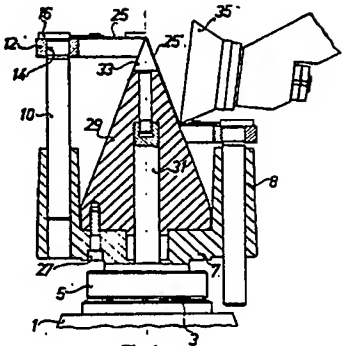


Fig.1

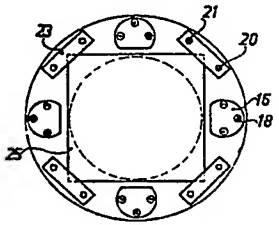


Fig.2

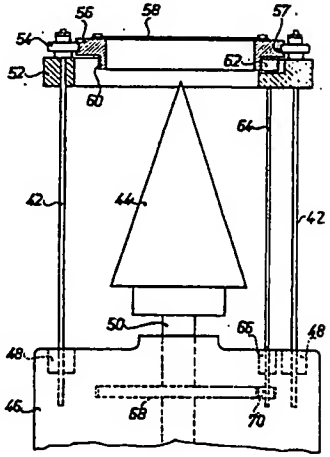


Fig.3